

Claims

1. An apparatus for forming a bottom end wall of a carton from a rectangular carton blank having open top and bottom ends, first, second, third and fourth body panels adjoining first, second, third and fourth bottom end closure panels, respectively, with the first and third bottom end closure panels oppositely disposed and scored to fold inwardly when the second and fourth bottom end closure panels are folded inwardly down to form the bottom of the carton, comprising:

a) a mandrel adapted to receive said carton blank through said open top end of said carton blank, with said bottom end closure panels extending beyond a distal free end of said mandrel, said distal free end indexable through a sequence of carton processing stations;

b) a folding station including:

i) a pair of oppositely disposed reciprocating break fingers to contact and fold inwardly said first and third bottom end closure panels; and

ii) biasing means for folding inwardly down said second and fourth bottom end closure panels; and

c) wherein said folding station is rotatable 90° between two functional orientations, a first orientation in which said break fingers are aligned in the direction of mandrel movement, and a second orientation in which said break fingers are perpendicular to the direction of

mandrel movement.

2. The apparatus as defined in Claim 1, wherein said biasing means is a hooder unit having first and second hooder elements each having a bottom surface angled acutely upward and inward from a peripheral edge.

3. The apparatus as defined in Claim 2, wherein said first and second hooder elements are generally rectangular in cross-section with adjacent sides.

4. The apparatus as defined in Claim 3, further comprising an overhanging region of said bottom surface of said first hooder element which extends over said bottom surface of said second hooder element to form a paper guide path.

5. The apparatus as defined in Claim 4, further comprising a J-flap pull finger recessed within said first hooder element and extending acutely past the plane of said first angled surface, said J-flap pull finger oriented to catch and fold a scored J-flap region of said second bottom end closure panel.

6. The apparatus as defined in Claim 5, wherein said

J-flap pull finger is movable between two positions, a first position extending past the plane of said first angled surface, and a second position recessed entirely within said first hooder element.

7. The apparatus as defined in Claim 6, further comprising an arcuate ski plate between said folding station and a sealing station for maintaining said bottom end closure panels in a folded state as said mandrel indexes said carton from said folding station to said sealing station.

8. The apparatus as defined in Claim 7, wherein said ski plate has a generally rectangular profile and a notch immediately adjacent said folding station sized to permit passage therethrough of said reciprocating forward break finger.

9. The apparatus as defined in Claim 8, wherein said mandrel is affixed to a turret which rotates said distal free end of said mandrel in a circular path through said carton processing stations.

10. The apparatus as defined in Claim 9, wherein said turret has affixed thereto a plurality of equally

spaced mandrels.

11. The apparatus as defined in Claim 10, wherein said turret has six equally spaced mandrels affixed thereto.

12. The apparatus as defined in Claim 11, further comprising a mandrel end cap affixed to said distal free end of said mandrel.

13. The apparatus as defined in Claim 12, wherein said mandrel end cap is removably affixed to said distal free end of said mandrel.

14. The apparatus as defined in Claim 13, wherein said mandrel end cap is sized to receive carton blanks having a volume selected from $\frac{1}{2}$ gallon and 2 liter.

15. The apparatus as defined in Claim 3, wherein said mandrel end cap is sized to receive carton blanks having a volume selected from 1 quart and 1 liter.

16. The apparatus as defined in Claim 15, further comprising a carton blank feeding station for loading rectangular carton blanks onto said mandrel, a heating station for heating said bottom end closure panels, a pressure sealing station for sealing together said folded

bottom end closure panels, and wherein said distal free end of said mandrel sequentially passes through said feeding station, said heating station, said folding station and said pressure sealing station.

17. The apparatus as defined in Claim 16, further comprising a cooling station, wherein said distal free end of said mandrel sequentially passes through said feeding station, said heating station, said folding station, said pressure sealing station and said cooling station.

18. The apparatus as defined in Claim 17, wherein said pressure sealing station includes a piston and a sealing plate for pressing said folded bottom end closure panels between said sealing plate and said end cap.

19. The apparatus as defined in Claim 18, wherein said break fingers are generally L-shaped and are pivotable about an end thereof.

20. The apparatus as defined in Claim 19, wherein said break fingers are pivotable to describe an arc of about 90°.

21. The apparatus as defined in Claim 1, wherein said break fingers are generally L-shaped and are pivotable about an end thereof.

22. The apparatus as defined in Claim 19, wherein said break fingers are pivotable to describe an arc of about 90°.

23. An apparatus for forming a bottom end wall of a carton from a rectangular carton blank having open top and bottom ends, first, second, third and fourth body panels adjoining first, second, third and fourth bottom end closure panels, respectively, with the first and third bottom end closure panels oppositely disposed and scored to fold inwardly when the second and fourth bottom end closure panels are folded inwardly down to form the bottom of the carton, comprising:

- a) a mandrel adapted to receive said carton blank through said open top end of said carton blank, with said bottom end closure panels extending beyond a distal free end of said mandrel, said distal free end indexable through a plurality of carton processing stations;
- b) a heating station;
- c) a folding station including:
 - i) a pair of oppositely disposed reciprocating break fingers to contact and fold inwardly said first and third bottom end closure panels; and

ii) a reciprocating hooder unit having first and second angled surfaces and a direction of movement along a longitudinal axis of said mandrel at said folding station such that said angled surfaces contact and fold inwardly down said second and fourth bottom end closure panels as said hooder unit moves toward said mandrel;

d) a pressure sealing station for sealing together said folded bottom end closure panels; and

e) wherein said distal free end of said mandrel sequentially indexes through said heating station, said folding station and said pressure sealing station, with said first body panel facing forward relative to the direction of mandrel movement.

24. The apparatus as defined in Claim 23, further comprising a J-flap pull finger recessed within said hooder unit and extending acutely past the plane of said first angled surface, said J-flap pull finger oriented to catch and fold a scored J-flap region of said second bottom end closure panel.

25. The apparatus as defined in Claim 24, wherein a portion of said first angled surface extends over said second angled surface to form a paper guide path.

26. The apparatus as defined in Claim 25, further comprising an arcuate ski plate between said folding station and a sealing station for maintaining said bottom

end closure panels in a folded state as said mandrel indexes said carton from said folding station to said sealing station.

27. The apparatus as defined in Claim 26, wherein said ski plate has a generally rectangular profile and a notch immediately adjacent said folding station sized to permit passage therethrough of said reciprocating forward break finger.

28. The apparatus as defined in Claim 27, wherein said mandrel is affixed to a turret which rotates said distal free end of said mandrel in a circular path through said carton processing stations.

29. The apparatus as defined in Claim 28, having affixed to said turret six equally spaced mandrels.

30. The apparatus as defined in Claim 29, further comprising a mandrel end cap removably affixed to said distal free end of said mandrel.

31. The apparatus as defined in Claim 30, further comprising a carton blank feeding station for loading rectangular carton blanks onto said mandrel, and wherein said distal free end of said mandrel sequentially passes

through said feeding station, said heating station, said folding station and said pressure sealing station.

32. The apparatus as defined in Claim 31, further comprising a cooling station, wherein said distal free end of said mandrel sequentially passes through said feeding station, said heating station, said folding station, said pressure sealing station and said cooling station.

33. The apparatus as defined in Claim 32, wherein said pressure sealing station includes a piston and a sealing plate for pressing said folded bottom end closure panels between said sealing plate and said mandrel end cap.

34. The apparatus as defined in Claim 23, wherein said break fingers are generally L-shaped and are pivotable about an end thereof.

35. The apparatus as defined in Claim 33, wherein said break fingers are pivotable to describe an arc of about 90°.

36. A method of forming a bottom end wall of a carton from a rectangular carton blank having open top and bottom ends, first, second, third and fourth body panels adjoining first, second, third and fourth bottom end closure panels, respectively, with the first and third bottom end closure panels oppositely disposed and scored to fold inwardly when the second and fourth bottom end closure panels are folded inwardly down to form the bottom of the carton, comprising the sequential steps:

- a) loading said carton blank onto a rotatable mandrel adapted to receive said carton blank through said open top end of said carton blank, with said bottom end closure panels extending beyond a distal free end of said mandrel and said first body panel facing in the direction of rotation;
- b) rotating said mandrel to a heating station;
- c) heating said bottom end closure panels;
- d) rotating said mandrel to a folding station;
- e) folding said first and third bottom end closure panels inward with a pair of oppositely disposed reciprocating break fingers;
- f) folding said second and fourth bottom end closure panels inwardly down with a reciprocating hooder unit having first and second angled surfaces and a direction of movement along a longitudinal axis of said mandrel at said folding station such that said angled surfaces contact and fold inwardly down said second and fourth bottom end closure panels as said hooder unit moves toward said

mandrel;

f) rotating said mandrel to a pressure sealing station; and

g) applying pressure to seal together said folded bottom end closure panels to form a bottom end wall of said carton.

37. The method as defined in Claim 36 wherein a distal free end of said mandrel traverses a circular path as said mandrel rotates about a central axis.

38. The method as defined in Claim 37, wherein said bottom end closure panels are maintained in a folded state during the rotation of said mandrel to said pressure sealing station by an arcuate ski plate having a generally rectangular profile between said folding station and said sealing station.

39. The method as defined in Claim 38 wherein said mandrel is adapted to receive said carton blank by means of a mandrel end cap removably affixed to said distal free end of said mandrel.

40. The apparatus as defined in Claim 39, further comprising a J-flap folding step wherein a J-flap pull finger extending past the plane of one of said angled

surfaces of said hooder unit is adapted to catch and fold a scored J-flap region of said second bottom end closure panel.

41. The method as defined in Claim 40, further comprising a cooling step subsequent to said folding step.

42. The method as defined in Claim 41, wherein said cooling step follows said sealing step.

43. The method as defined in Claim 41, wherein said cooling step is simultaneous with said sealing step.